CLAIMS

What is claimed is:

1. A double-sided light emitting device comprising:

lower and upper substrates;

an emission element formed between an inner surface of the upper substrate and an inner surface of the lower substrate and emitting predetermined light;

an upper layer of polarizing material disposed on at least one of inner and outer surfaces of the upper substrate; and

a lower layer of polarizing material disposed on at least one of inner and outer surfaces of the lower substrate.

2. The double-sided light emitting device as claimed in claim 1, wherein the lower and upper layers of polarizing material are coating layers coated on the outer surfaces of the lower and upper substrates, respectively, and are disposed so that polarization axes of the lower and upper layers of polarizing material are perpendicular to each other.

3. The double-sided light emitting device as claimed in claim 1, wherein the lower and upper layers of polarizing material are coating layers coated on the inner surfaces of the lower and upper substrates, respectively, and are disposed so that polarization axes of the lower and upper layers of polarizing material are perpendicular to each other.

4. The double-sided light emitting device as claimed in claim 1, wherein the upper layer of polarizing material is a coating layer coated on the inner surface of the upper substrate, and the lower layer of polarizing material is a coating layer coated on the outer surface of the lower substrate, and the lower and upper layers of polarizing material are disposed so that polarization axes of the lower and upper layers of polarizing material are perpendicular to each other.

5. The double-sided light emitting device as claimed in claim 1, wherein the upper layer of polarizing material is a coating layer coated on the outer surface of the upper substrate, and the lower layer of polarizing material is a coating layer coated on the inner surface of the lower substrate, and the lower and upper layers of polarizing material are disposed so that polarization axes of the lower and upper layers of polarizing material are perpendicular to each other.

6. The double-sided light emitting device as claimed in claim 1, wherein the lower and upper layers of polarizing material are disposed on ones of inner and outer surfaces of the lower and upper substrates respectively so that polarization axes of the lower and upper layers of polarizing material are perpendicular to each other.

7. The double-sided light emitting device as claimed in claim 1, wherein the lower and upper layers of polarizing material each are a coating layer having a thickness from about 0.1 μm to 50.0 μm.

8. A double-sided light emitting device comprising:

lower and upper substrates;

an emission element formed between an inner surface of the upper substrate and an inner surface of the lower substrate and emitting predetermined light;

an upper polarizing plate disposed on any one of inner and outer surfaces of the upper substrate; and

a lower polarizing plate disposed on any one of inner and outer surfaces of the lower substrate.

9. The double-sided light emitting device as claimed in claim 8, wherein the lower and upper polarizing plates are polarizing films bonded on the inner surfaces of the lower and upper substrates, respectively, and are disposed so that polarization axes of the lower and upper polarizing plates are perpendicular to each other.

10. The double-sided light emitting device as claimed in claim 8, wherein the upper polarizing plate is a polarizing film bonded on the inner surface of the upper substrate, and the lower polarizing plate is a polarizing film bonded on the outer surface of the lower substrate, and the lower and upper polarizing plates are disposed so that polarization axes of the lower and upper polarizing plates are perpendicular to each other.

11. The double-sided light emitting device as claimed in claim 8, wherein the upper polarizing plate is a polarizing film bonded on the outer surface of the upper substrate, and the lower polarizing plate is a polarizing film bonded on the inner surface of the lower substrate, and the lower and upper polarizing plates are disposed so that polarization axes of the lower and upper polarizing plates are perpendicular to each other.

12. The double-sided light emitting device as claimed in claim 8, wherein the lower and upper polarizing plates are polarizing films bonded on the outer surfaces of the lower and upper substrates, respectively, and are disposed so that polarization axes of the lower and upper polarizing plates are perpendicular to each other.

13. The double-sided light emitting device as claimed in claim 8, wherein the lower and upper polarizing plate each are a polarizing film having a thickness from about 50 μm to 300 μm.

14. The double-sided light emitting device as claimed in claim 8, wherein the lower and upper polarizing plates have polarization axes disposed to be perpendicular to each other.

15. A double-sided light emitting device comprising:

lower and upper substrates;

an emission element formed between an inner surface of the upper substrate and an inner surface of the lower substrate and emitting predetermined light;

an upper polarizing element disposed on any one of inner and outer surfaces of the upper substrate;

a lower polarizing element disposed on any one of inner and outer surfaces of the lower substrate;

an upper compensating plate disposed between the upper polarizing element and the emission element; and

an lower compensating plate disposed between the lower polarizing element and the emission element,

wherein when a phase difference retardation value of each of the compensating plates is denoted by x, the phase difference retardation value, x, satisfies the following expression:

$n\lambda/2 \leq x \leq (n+1)\lambda/2$, where n is an integer number.

16. The double-sided light emitting device as claimed in claim 15, wherein a crossing angle between a phase difference retardation axis of the lower compensating plate disposed between the lower polarizing element and the emission element and a polarization axis of the lower polarizing element is opposite to a crossing angle between a phase difference retardation axis of the upper compensating plate disposed between the upper polarizing element and the emission element and a polarization axis of the upper polarizing element.

17. The double-sided light emitting device as claimed in claim 15, wherein the lower polarizing element is disposed on the outer surface of the lower substrate, and the lower compensating plate is disposed between the lower polarizing element and the outer surface of the lower substrate, and

the upper polarizing element is disposed on the outer surface of the upper substrate, and the upper compensating plate is disposed between the upper polarizing element and the outer surface of the upper substrate.

18. The double-sided light emitting device as claimed in claim 15, wherein the lower polarizing element is disposed on the outer surface of the lower substrate, and the lower compensating plate is disposed between the lower polarizing element and the outer surface of the lower substrate, and

the upper polarizing element is disposed on the inner surface of the upper substrate, and the upper compensating plate is disposed between the upper polarizing element and the inner surface of the upper substrate.

19. The double-sided light emitting device as claimed in claim 15, wherein the lower polarizing element is disposed on the inner surface of the lower substrate, and the lower compensating plate is disposed between the lower polarizing element and the inner surface of the lower substrate, and

the upper polarizing element is disposed on the inner surface of the upper substrate, and the upper compensating plate is disposed between the upper polarizing element and the inner surface of the upper substrate.

20. The double-sided light emitting device as claimed in claim 15, wherein the lower polarizing element is disposed on the inner surface of the lower substrate, and the lower compensating plate is disposed between the lower polarizing element and the inner surface of the lower substrate, and

the upper polarizing element is disposed on the outer surface of the upper substrate, and the upper compensating plate is disposed between the upper polarizing element and the outer surface of the upper substrate.

21. The double-sided light emitting device as claimed in claim 17, wherein the lower and upper compensating plates include at least one compensating film having a predetermined phase difference retardation axis.

22. The double-sided light emitting device as claimed in claim 15, wherein, when the lower and upper compensating plates have phase difference retardation axes equal to each other, the lower and upper polarizing elements have polarization axes parallel to each other.

23. The double-sided light emitting device as claimed in claim 15, wherein, when the lower and upper compensating plates have phase difference retardation axes opposite to each other, the lower and upper polarizing elements have polarization axes perpendicular to each other.

24. A double-sided light emitting device comprising:

lower and upper substrates;

an emission element formed between an inner surface of the upper substrate and an inner surface of the lower substrate and emitting predetermined light;

an upper polarizing element disposed on any one of inner and outer surfaces of the upper substrate;

a lower polarizing element disposed on any one of inner and outer surfaces of the lower substrate; and

a compensating plate disposed at least one of between the upper polarizing element and the emission element and between the lower polarizing element and the emission element,

wherein the emission element emits light toward both the lower and upper substrates.

25. The double-sided light emitting device as claimed in claim 24, wherein a rotational angle between a lower compensating plate, disposed between the lower polarizing element and the emission element, and the lower polarizing element is opposite to a rotational angle between an upper compensating plate, disposed between the upper polarizing element and the emission element, and the upper polarizing element.

26. The double-sided light emitting device as claimed in claim 24, wherein a phase difference between a lower compensating plate, disposed between the lower polarizing element and the emission element, and the lower polarizing element, and a phase difference between an upper compensating plate, disposed between the upper polarizing element and the emission element, and the upper polarizing element, are summed to be $n\lambda/2$, where n is an integer number except for zero (0).

27. The double-sided light emitting device as claimed in claim 24, wherein when a phase difference retardation value of each of the compensating plates is denoted by x, the phase difference retardation value, x, satisfies the following expression:

$n\lambda/2 \leq x \leq (n+1)\lambda/2$, where n is an integer number.

28. The double-sided light emitting device as claimed in claim 24, wherein the compensating plate includes at least one compensating film.

29. The double-sided light emitting device as claimed in claim 28, wherein the compensating plate includes a compensating film having a same retardation axis.

30. The double-sided light emitting device as claimed in claim 28, wherein the compensating plate includes compensating films having a different phase difference retardation axis.

31. The double-sided light emitting device as claimed in claim 24, wherein the compensating plate includes an upper compensating plate disposed between the upper polarizing element and the emission element.

32. The double-sided light emitting device as claimed in claim 31, wherein the upper polarizing element is disposed on the inner surface of the upper substrate, and the upper compensating plate is disposed between the upper polarizing element and the inner surface of the upper substrate.

33. The double-sided light emitting device as claimed in claim 31, wherein the upper polarizing element is disposed on the outer surface of the upper substrate, and the upper compensating plate is disposed between the upper polarizing element and the outer surface of the upper substrate.

34. The double-sided light emitting device as claimed in claim 31, wherein the upper compensating plate includes at least one compensating film having a predetermined phase difference retardation axis.

35. The double-sided light emitting device as claimed in claim 24, wherein the compensating plate includes a lower compensating plate disposed between the lower polarizing element and the emission element.

36. The double-sided light emitting device as claimed in claim 35, wherein the lower polarizing element is disposed on the outer surface of the lower substrate, and the lower compensating plate is disposed between the lower polarizing element and the outer surface of the lower substrate.

37. The double-sided light emitting device as claimed in claim 35, wherein the lower polarizing element is disposed on the inner surface of the lower substrate, and the lower compensating plate is disposed between the lower polarizing element and the inner surface of the lower substrate.

38. The double-sided light emitting device as claimed in claim 35, wherein the upper compensating plate includes at least one compensating film having a predetermined phase difference retardation axis.

39. The double-sided light emitting device as claimed in claim 24, wherein the compensating plate includes:

an upper compensating plate disposed between the upper polarizing element and the emission element; and

a lower compensating plate disposed between the lower polarizing element and the emission element.

40. The double-sided light emitting device as claimed in claim 39, wherein, when the lower and upper compensating plates have phase difference retardation axes equal to each other, the lower and upper polarizing elements have polarization axes parallel to each other.

41. The double-sided light emitting device as claimed in claim 39, wherein, when the lower and upper compensating plates have phase difference retardation axes opposite to each other, the lower and upper polarizing elements have polarization axes perpendicular to each other.

42. The double-sided light emitting device as claimed in claim 39, wherein the lower polarizing element is disposed on the outer surface of the lower substrate, and the lower compensating plate is disposed between the lower polarizing element and the outer surface of the lower substrate, and

the upper polarizing element is disposed on the outer surface of the upper substrate, and the upper compensating plate is disposed between the upper polarizing element and the outer surface of the upper substrate.

43. The double-sided light emitting device as claimed in claim 39, wherein the lower polarizing element is disposed on the outer surface of the lower substrate, and the lower compensating plate is disposed between the lower polarizing element and the outer surface of the lower substrate, and

the upper polarizing element is disposed on the inner surface of the upper substrate, and the upper compensating plate is disposed between the upper polarizing element and the inner surface of the upper substrate.

44. The double-sided light emitting device as claimed in claim 39, wherein the lower polarizing element is disposed on the inner surface of the lower substrate, and the lower compensating plate is disposed between the lower polarizing element and the inner surface of the lower substrate, and

the upper polarizing element is disposed on the inner surface of the upper substrate, and the upper compensating plate is disposed between the upper polarizing element and the outer surface of the upper substrate.

45. The double-sided light emitting device as claimed in claim 39, wherein the lower polarizing element is disposed on the inner surface of the lower substrate, and the lower compensating plate is disposed between the lower polarizing element and the inner surface of the lower substrate, and

the upper polarizing element is disposed on the outer surface of the upper substrate, and the upper compensating plate is disposed between the upper polarizing element and the outer surface of the upper substrate.

46. The double-sided light emitting device as claimed in claim 39, wherein each of the lower and upper compensating plates includes at least one compensating film having a predetermined phase difference retardation axis.

47. The double-sided light emitting device as claimed in claim 46, wherein when a phase difference retardation value of each of the lower and upper compensating plates is denoted by x, the phase difference retardation value, x, satisfies the following expression:

$n\lambda/2 \leq x \leq (n+1)\lambda/2$, where n is an integer number.

48. A double-sided light emitting device comprising:

lower and upper substrates;

an emission element formed between an inner surface of the upper substrate and an inner surface of the lower substrate and emitting predetermined light;

an upper polarizing element disposed on any one of inner or outer surfaces of the upper substrate;

a lower polarizing element disposed on any one of inner or outer surfaces of the lower substrate;

an upper compensating plate disposed between the upper polarizing element and the emission element; and

a lower compensating plate disposed between the lower polarizing element and the emission element,

wherein at a position where light emitted from the emission element is observed, the light emitted from the emission element is transmitted, and all external light incident at the observed position and at a position opposite to the observed position are blocked, and external light reflected within the emission element is blocked.

49. The double-sided light emitting device as claimed in claim 48, wherein, when the lower and upper compensating plates have phase difference retardation axes equal to each other, the lower and upper polarizing elements have polarization axes parallel to each other.

50. The double-sided light emitting device as claimed in claim 48, wherein, when the lower and upper compensating plates have phase difference retardation axes opposite to each other, the lower and upper polarizing elements have polarization axes perpendicular to each other.

51. The double-sided light emitting device as claimed in claim 48, wherein the lower polarizing element is disposed on the outer surface of the lower substrate, and the lower compensating plate is disposed between the lower polarizing element and the outer surface of the lower substrate, and

the upper polarizing element is disposed on the outer surface of the upper substrate, and the upper compensating plate is disposed between the upper polarizing element and the outer surface of the upper substrate.

52. The double-sided light emitting device as claimed in claim 48, wherein the lower polarizing element is disposed on any one of the inner and outer surfaces of the lower substrate, and the lower compensating plate is disposed between the lower polarizing element and the lower substrate, and

the upper polarizing element is disposed on any one of the inner and outer surfaces of the upper substrate, and the upper compensating plate is disposed between the upper polarizing element and the inner substrate.

53. The double-sided light emitting device as claimed in claim 48, wherein the lower and upper compensating plates include at least one compensating film having a predetermined phase difference retardation axis.

54. The double-sided light emitting device as claimed in claim 48, wherein when an angle between the lower polarizing element and the lower compensating plate is $n\pi/4$, and an angle between the upper polarizing element and the upper compensating plate is - $n\pi/4$, the compensating plates have a phase difference retardation value of $\lambda/4$.

55. A double-sided light emitting device comprising:

lower and upper substrates;

an emission element formed between an inner surface of the upper substrate and an inner surface of the lower substrate and emitting predetermined light;

an upper polarizing element disposed on any one of inner or outer surfaces of the upper substrate; and

a lower polarizing element disposed on any one of inner or outer surfaces of the lower substrate,

wherein the lower and upper polarizing elements are disposed so that polarization axes of the lower and upper polarizing elements are perpendicular to each other, and

at an observing position where light is emitted from the emission element, the light emitted from the emission element is transmitted and all external light incident at the observing position and at a position opposite to the observing position are blocked.

56. The double-sided light emitting device as claimed in claim 55, wherein the lower and upper polarizing elements each are a coating layer of polarizing material having a thickness from about 0.1 μm to 50.0 μm.

57. The double-sided light emitting device as claimed in claim 55, wherein the lower and upper polarizing elements each are a polarizing film having a thickness from about 50 μm to 300 μm.

58. The double-sided light emitting device as claimed in claim 55, wherein the lower and upper polarizing elements are disposed on the inner surfaces of the lower and upper substrates respectively or on the outer surfaces of the lower and upper substrates respectively.

59. The double-sided light emitting device as claimed in claim 55, wherein the lower and upper polarizing elements are disposed on the inner surface of the upper substrate and the outer surface of the lower substrate respectively, or on the outer surface of the upper substrate and the inner surface of the lower substrate respectively.